Lab 3 Master Document

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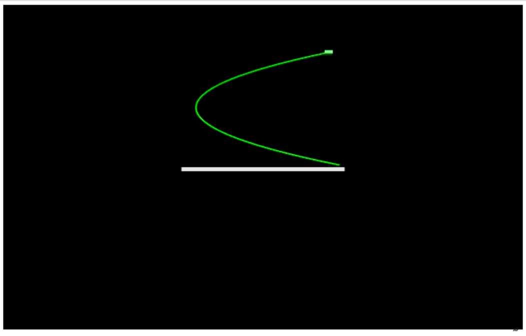
48 This problem had us make a 'cart' on a 'track', and give it some velocity in the x-direction. In the later part of the problem, we give it a velocity in the y-direction.

```
#
#  Physics 241
#  Lab 3
#  Chapter 2 Problem 48
#  Group 4
#  Driver: Cam Kimber
#  Navigator: James Gallegos
#  13 September 2017
#
##################################
```

In [2]:
```
from vpython import *
```



Here we declare the track and the cart.

In [3]:
```
track = box(pos = vector(0, -0.025, 0), size = vector(2.0, 0.05, 0.10), color = color.white)
cart  = box(pos = vector(0.951, 0.025, 0),  size = vector(0.1, 0.04, 0.06), color = color.green, make_trail = True)
m_cart  = 0.8                              # Kilograms
p_cart  = m_cart * vector(-0.5, 0.1, 0)  # Kilogram meters/second
delta_t = 0.001                             # Seconds
t       = 0                                # Seconds
while t < 14:
    rate(2000)
```

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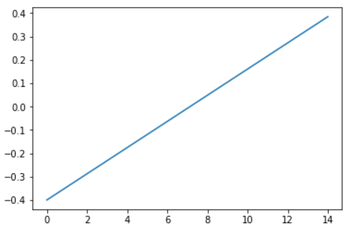
This problem was similar, but had us make a plot of the cart's position.

Here we begin by making the cart and track objects, and giving the cart some initial conditions. Afterwards is the loop that makes the cart move on the track. For this problem, we make a graph that plots either the x component of the cart's position or the x component of the cart's momentum.

In [11]:
```
track = box(pos = vector(0, -0.025, 0), size = vector(2.0, 0.05, 0.10), color = color.white)
cart  = box(pos = vector(0.951, 0.025, 0),  size = vector(0.1, 0.04, 0.06), color = color.green, make_trail = True)
m_cart  = 0.8                              # Kilograms
p_cart  = m_cart * vector(-0.5, 0.1, 0)  # Kilogram meters/second
delta_t = 0.01                              # Seconds
t       = 0                                # Seconds
while t < 14:
    rate(5000)
    F_air = vector(.056, 0, 0)
    p_cart = p_cart + F_air * delta_t
    cart.pos = cart.pos + (p_cart)/(m_cart) * delta_t
    time.append(t)
    x_pos.append(p_cart.x)
    t+=delta_t
plt.plot(time,x_pos)
print("To reach the end of the track, it takes", track.size.x * m_cart/p_cart.x, "seconds.")
print("End of the loop")
```

```
To reach the end of the track, it takes 4.160599126274123 seconds.
End of the loop
```



In [ ]:

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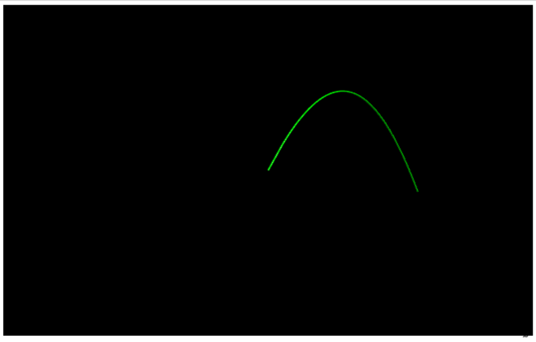
This problem had us write an iterative model predicting the motion of a tennis ball

In [2]:
```python
from vpython import *
from matplotlib import pyplot as plt
from math import sin, cos, pi
%matplotlib inline
```



In [4]:
```python
tennis_ball = sphere(radius = 0.5, pos = vector(0, 0, 0), color = color.green, make_trail=True)
theta       = pi/3                                          #  Radians
velocity    = vector(55 * cos(theta), 55 * sin(theta), 0)   #  Meters/sec
m_ball      = 0.055                                         #  Grams
p_ball      = m_ball * velocity                             #  Kilogram m/s
gravity     = vector(0, -9.81, 0)                           #  Kilograms m/s^2
t           = 0                                             #  Seconds
delta_t     = 0.0001                                           #  Seconds
```

In [5]:
```python
while t < 10:
    rate(10000)
    tennis_ball.pos += (velocity) * delta_t
    velocity += gravity * delta_t
    t += delta_t
```

In [4]:
```python
print(velocity)
```